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(54) **Turbo-supercharger comprising a device for regulating the absorption capacity of the turbine**

(57) The turbine includes an annular flexible diaphragm (5) carrying a guide vane ring (6), flexing of the diaphragm changing the cross-section of the gas inlet in front of the turbine wheel (3).

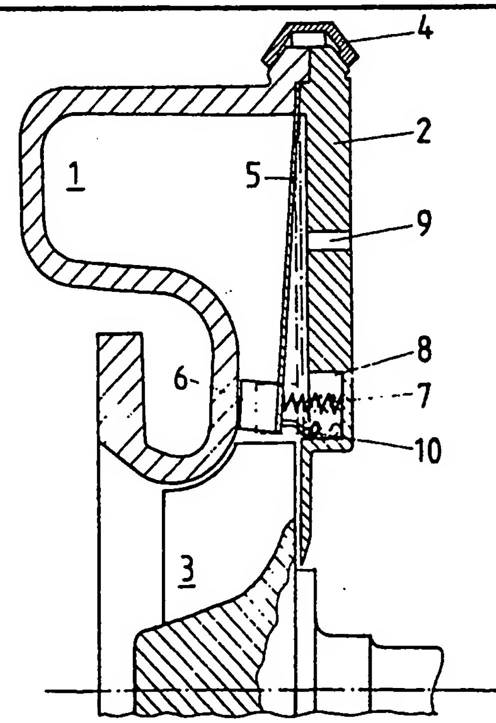

FIG.1

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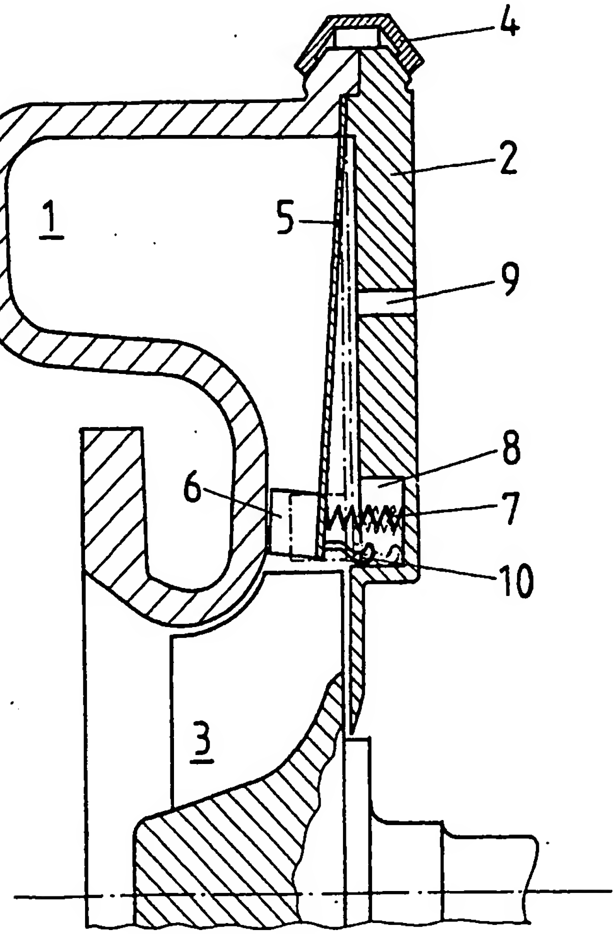

FIG.1

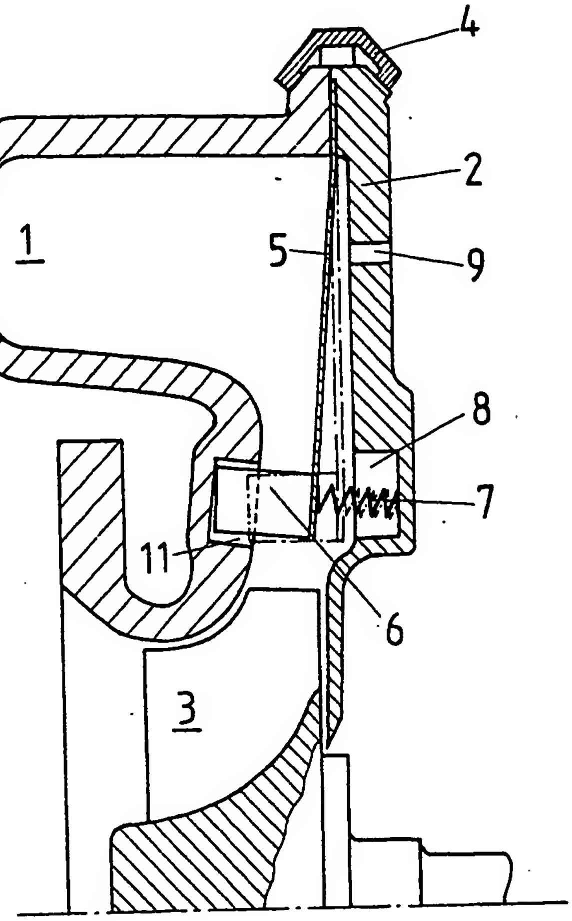

FIG. 2

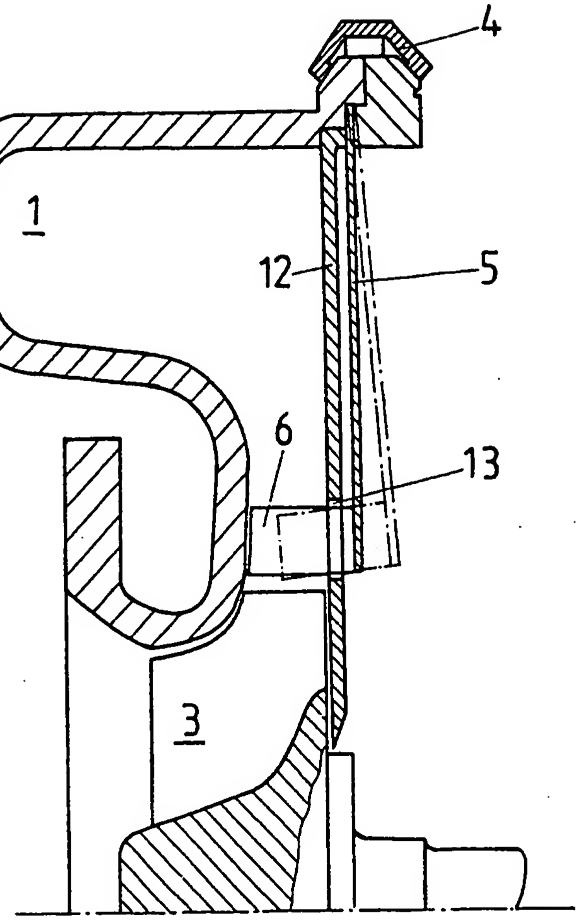

FIG.3

SPECIFICATION

Turbo-supercharger comprising a device for regulating the absorption capacity of the turbine

The present invention relates to a turbo-supercharger comprising a device for regulating the absorption capacity of the turbine.

Due to the different operating characteristics of a combustion engine and a turbo-supercharger, it is difficult to achieve high effective mean pressure P_{me} at reduced speed. This difficulty increases with the degree of supercharging used.

The solutions hitherto proposed for this are constructionally expensive and have, therefore, not become accepted for turbines of turbo-superchargers. This includes, for example, a regulating device in which, in a gas inlet housing which is constructed as a spiral, the cross-section of the spiral can be changed continuously by means of an adjustable strap. This solution necessitates a not inconsiderable constructional outlay, particularly with respect to obtaining satisfactory sealing of the said strap.

An ideal solution would be a turbine with adjustable guide and rotor vanes. However, it has hitherto not been possible as yet to implement a reliable and economically acceptacle construction of this type.

The invention seeks to mitigate the disadvantages of the known relevant devices and provides a Turbo-supercharger, comprising a device for regulating the absorption capacity of the turbine, in which the regulating device is provided with a annular diaphragm attached to the gas inlet housing (1), the diaphragm at its outer periphery being deformable out of its plane and around its points of attachment, located on the outer periphery, in the axial direction of the turbine in order to enable the cross-section of the inlet in front of the turbine wheel to be adapted to the amount of exhaust gas delivered in each case by the engine, and the inner boundary of the diaphragm being loccated in the vicinity of the outer periphery of the guide vane ring of the turbine wheel.

Illustrative embodiments of the subject of the invention are represented in the drawing, in which:

Figure 1 shows the turbine part of a turbo-supercharger according to the invention, comprising a diaphragm, accommodated inside the gas inlet housing, which incorporates a guide vane ring,

Figure 2 shows an embodiment comprising a diaphragm which is located on the inside and a guide vane ring which can be partially recessed, and

Figure 3 shows an embodiment comprising a diaphragm which is attached outside the gas inlet housing and which incorporates a guide vane ring.

In Fig. 1 the gas inlet housing is designated by 1 and the associated housing cover of a turbo-supercharger, of which here only the turbine part is shown, by 2. The turbine concerned here is a radial turbine through the turbine wheel 3 of which exhaust gases coming from the gas inlet housing flow from the outside to the inside in the direction of the axis of the shaft. The gas inlet housing 1 and the housing cover 2 are joined to one another at the periphery of the two housing parts by a cross-sectionally V-shaped clamping ring 4.

An annular diaphragm 5 is clamped at its outer periphery between the outer flange of the gas inlet housing 1 and the housing cover 2.

Its inner boundary is a circle which is somewhat larger than the periphery of the turbine wheel 3. At this inner boundary of the diaphragm 5 a guide vane ring 6 is provided which extends into the gas inlet housing. On the opposite side, facing the housing cover 2, of the diaphragm a number of springs 7, distributed over the periphery, is provided which are supported on the housing cover 2 in recesses 8 of the latter and which, when the turbine is standing still or with weak loading, press the diaphragm into the gas inlet housing 1 until the guide vane ring strikes against the housing. With weak loading, this keeps the inlet cross-section directly in front of the guide vane ring 6, and also the cross-section of the passage in the area of the guide vanes, narrow which, at reduced speed, produces approximately the same angles for the speed triangles for the entry into the rotor vanes as under full load, at which the gas pressure presses the diaphragm outward to such an extent that the full inlet cross-section becomes available in front of the guide vane ring. This is why with reduced loading, when the turbine has to process a reduced flow of exhaust gas, it has a high efficiency, the compressor handles a greater amount of air and the engine power increases, with respect to a normal turbo-supercharger, whilst the engine speed remains the same.

In order to protect the diaphragm, which can consist, for example, of thin spring-elastic sheet metal, from being overheated by the exhaust gases in the housing cover 2 openings 9 are provided through which cooling air tapped off from the compressor can be conducted to the rear of the diaphragm. The flow of cooling air can be changed by known means, not shown, in order to thus adjust the diaphragm in the respective desired manner. In order to seal the space behind the diaphragm with respect to the gas inlet housing, a sealing ring 10 or a metal bellows can be provided at the inner end of the diaphragm 5.

The fully open position of the diaphragm is drawn in dot-dashed lines. In this position the guide vane ring opens a part of the inlet cross-section in front of the turbine rotor

wheel.

This is the case in the embodiment shown in Fig. 2, in which in the wall of the gas inlet housing 1 an annular groove 11 is provided which, in the reduced-load configuration of the diaphragm, accommodates a part of the guide vane ring 6. When the gas inlet cross-section is fully open, that is with full load, the guide vanes cover the whole inlet cross-section, as is shown by the position drawn in dot-dashed lines. More advantageously, instead of the annular groove 11, recesses in the wall of the housing 1 are provided for each individual vane, the cross-section of these recesses corresponding to the cross-section of the guide vanes. This prevents a lateral flow around the guide vane ring 6 via the annular groove 11, which improves the action of the regulating device even further.

In the embodiment according to Fig. 2, in the open position the guide vane ring is located a little farther to the right than in the first embodiment so that in the closed position a more advantageous inflow and better reduced-load efficiency is produced.

Although the embodiment shown in Fig. 3 is no improvement with respect to reduced-load efficiency, in comparison with the variant according to Fig. 1, since here, too, the guide vane ring, in its fully open position, opens a part of the inlet cross-section, the diaphragm 5 is here shielded against the flow of exhaust gas by a partition 12, however, so that special cooling of the diaphragm 5 can be omitted here. The partition 12 must be provided with openings for the guide vane ring 6.

The diaphragm can be actuated by a pressure medium, for example the exhaust gas itself, which is introduced into the space delimited by the partition 12 and the diaphragm 5, or by any other mechanical, electric, magnetic, hydraulic or pneumatic means, which is also applicable to the other two embodiments as alternative to actuating the diaphragm by means of exhaust gas pressure. The diaphragm traverse can be derived, for example, from the engine speed or any other suitable operating value of the engine or of the turbo-supercharger.

The guide vanes can also be mounted at the gas inlet housing or alternately at the housing and at the diaphragm.

A similar control the inlet cross-section is also possible with twin turbines, but with higher constructional outlay.

CLAIMS

1. A turbo-supercharger, comprising a device for regulating the absorption capacity of the turbine, which the regulating device is provided with an annular diaphragm attached to the gas inlet housing (1), the diaphragm at its outer periphery being deformable out of its plane and around its points of attachment, located on the outer periphery, in the axial direction of the turbine in order to enable the cross-section of the inlet in front of the turbine wheel to be adapted to the amount of exhaust gas delivered in each case by the engine, and the inner boundary of the diaphragm being located in the vicinity of the outer periphery of the guide vane ring of the turbine wheel.

2. A turbo-supercharger according to Claim 1, in which the inner periphery of the diaphragm is provided with a guide vane ring.

3. A turbo-supercharger according to Claim 2, in which at the side opposite to the guide vane ring, of the gas inlet housing recesses which correspond to the cross-section of the guide vanes are provided for accommodating the guide vane ring.

4. A turbo-supercharger according to Claim 1, in which the diaphragm is arranged inside the gas inlet housing.

5. A turbo-supercharger according to Claim 2, in which the diaphragm is provided outside the gas inlet housing.

6. A turbo-supercharger according to Claim 1, in which the diaphragm is contructed to be elastic.

7. A turbo-supercharger according to Claim 1, in which the diaphragm can be actuated by being loaded with a gaseous pressure medium.

8. A turbo-supercharger according to Claim 1, in which springs are provided which load the diaphragm in the direction of a reduction of the cross-section of the inlet in front of the turbine wheel.

9. A turbo-supercharger according to Claim 1, in which the outer periphery of the diaphragm is firmly clamped between the gas inlet housing (1) and the housing cover.

10. A turbo-supercharger according to Claim 1, in which the outer periphery of the diaphragm is attached to the gas inlet housing in the manner of a hinge.

11. A turbo-supercharger according to Claim 1, in which in the housing cover openings are provided for feeding in a flow of cooling air.

12. A turbo-supercharger according to Claim 10, in which at the inner periphery of the diaphragm an annular sealing element is provided which seals off the part which contains the exhaust gas, of the gas inlet housing against the flow of cooling air.

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